ARES: an atmospheric electricity instrument proposed for EXOMARS

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The Atmospheric Relaxation and Electric Field sensor (ARES) experiment on the Geophysical and Environmental Package (GEP) of the EXOMARS project is devoted to the investigation of atmospheric electric phenomena. It will measure the ionisation state of the atmosphere, the electric fields that result from various charging mechanisms and investigate the planet global electrical circuit. Atmospheric electrical phenomena are an important issue in dust transport and surface and atmospheric chemistry. Intense electric fields, possibly capable of producing electrical breakdown, are expected at the time of dust storms and in the vicinity of dust devils that could be the source of electromagnetic waves. Electrification processes may also affect a landed vehicle, such as the GEP or the EXOMARS rover, and could be an important issue for their safe and reliable operation and, more generally, for future landed systems in the context of the human exploration of Mars.

The proposed instrument, ARES, is a double probe with two cylindrical electrodes that can be installed on the meteorological mast. It measures the magnitude of the vertical component of the electric field and the potential of the GEP with respect to background from DC to 2 kHz up to ~ 250 V/m which can be increased to ~20 kV/m in dedicated modes of operation. The vertical electric component of electromagnetic waves and the AC fluctuations of the potential of the rover will be measured in the frequency range from 8 Hz to 4 kHz. This channel may also be used to detect the impacts of charged dust particles and infer their fluxes and charge distribution. Operated in the relaxation probe mode, the instrument will also provide a measurement of the atmospheric conductivity separately for positive and negative ions. We present the results obtained in the terrestrial atmosphere with prototypes of ARES on board stratospheric balloons.